

**Written Amendment**  
(Amendment based on Section 11)

To Ms. Junko YOSHIMIZU, Examiner at the Patent Office

**1. Identification of the International Application**

PCT/JP98/02954

**2. Applicant**

Name: NITTO DENKO CORPORATION  
Address: 1-2, Shimohozumi, 1-chome  
Ibaraki-shi, Osaka 567-8680, JAPAN  
Nationality: Japan  
Residence: Japan

**3. Attorney**

Name: (9555) Hiroyuki IKEUCHI  
Address: Suite 401, Umeda Plaza Building,  
3-25, Nishitenma, 4-chome, Kita-ku,  
Osaka-shi, Osaka 530-0047, JAPAN

**4. Object of Amendment:** Claims

**5. Contents of Amendment**

As shown in separate sheets, we amend claim 1, and cancel claim 4.

**6. List of appended documents**

New page 15 (English translation: page 11) of Claims

## Written Reply

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4. Date of Notification: 02.03.1999 (mailing date)

### 5. Contents of this Argument

We have received the opinion in accordance with §13 Japanese Law Concerning the International Application of the Patent Cooperation Treaty and Related Matters (PCT rule 66), and would like to respond with the following argument.

(1) The Applicant filed a Written Amendment (an amendment based on § 11) to amend the claims on the same date of this Written Reply.

The amended claim 1 includes the old claim 4. Accordingly, claim 4 has been cancelled.

(2) The Examiner rejected the novelty or inventive step of the present claims, in view of the references cited in the International Search Report. To overcome this rejection, the Applicant has amended the claims as mentioned above, and the Applicant believes that this amendment makes the difference between the claimed invention and the references cited in the

International Search Report clear, and that the present invention has both novelty and inventive step over the cited references. The reasons are as follows.

(3) Explanation on the claimed invention

As described in the amended claim 1, the invention relates to “a composite reverse osmosis membrane comprising: a porous support; and a polyamide skin layer formed on the porous support, wherein the contact angle between the polyamide skin layer surface and water is no more than 45°, the salt rejection is at least 98%, and the permeate flow rate is at least 0.5m<sup>3</sup>/m<sup>2</sup>·day when evaluated by using feed water which has pH 6.5, 0.05 weight % of salt, an operation pressure of 5kgf/cm<sup>2</sup> and a temperature of 25°C”.

The composite reverse osmosis membrane of the claimed invention maintains a high salt rejection as well as having improved flux and excellent water permeability (p.2, lines 26-28 of the Description). Specifically, by using the composite reverse osmosis membrane, components such as salts can be sufficiently separated even at a low operation pressure. Because of the low pressures, water purification equipment can be composed of pipes made of inexpensive materials such as polyvinyl chloride, providing a reduction in costs (p.10, lines 19-25 of the Description). Moreover, the composite reverse osmosis membrane of the claimed invention can be used for a domestic water purification apparatus or the like since it can be operated at city water level pressures (p.10, lines 25-28 of the Description).

(4) Comparison of the claimed invention and the cited references

① JP 61-46203, A (Document 1)

Document 1 relates to a composite semipermeable membrane which provides a high rejection and permeate speed. The reference discloses that the contact angle between the membrane and water is 65° or less.

As the Examiner has pointed out, the claimed constituent feature that the contact angle is 45° or less is included in the range of the Document 1 in which the contact angle is 65° or less.

However, while Document 1 describes that the angle is no more than 65° or no more than 62° (p.2, right column, line 19) it does not describe or suggest that the contact angle is determined to be 45° or less. Also Document 1 has no description or suggestion about any advantages concerning the angle, unlike the claimed invention.

As mentioned above, the claimed composite reverse osmosis

membrane having a contact angle of no more than  $45^\circ$  shows excellent performance. For example, the salt rejection is at least 98% and the permeate flow rate is at least  $0.5\text{m}^3/\text{m}^2\cdot\text{day}$  when evaluated by using feed water which has pH 6.5, 0.05 weight % of salt, an operation pressure of  $5\text{kgf}/\text{cm}^2$  and a temperature of  $25^\circ\text{C}$ .

As a comparative experiment the composite reverse osmosis membrane of the Document 1 was run under the same (low-pressure) conditions, and even for the membrane of the highest performance, the permeate flow rate is  $0.004\text{m}^3/\text{m}^2\cdot\text{day}$ . This value is less than 1/100 of the claimed composite reverse osmosis membrane. This result demonstrates the difference in the performance between the claimed composite reverse osmosis membrane and that of Document 1. The advantage of the claimed invention was not within the expected range for any persons skilled in the art at the time of the application.

In the process described in Document 1, a composite reverse osmosis membrane having a contact angle of no more than  $45^\circ$  cannot be produced. Such a composite reverse osmosis membrane is produced in the claimed method (for example, a method described in claim 6). Therefore, the method of producing a composite reverse osmosis membrane having a contact angle of no more than  $45^\circ$  has not been disclosed before the present application.

In conclusion, Document 1 has no description or suggestion about a contact angle of no more than  $45^\circ$ , or techniques for producing such a composite reverse osmosis membrane, even though the range of the claimed contact angle (no more than  $45^\circ$ ) seems to be included in the range (no more than  $65^\circ$ ) of Document 1. Therefore, Document 1 does not suggest the claimed composite reverse osmosis membrane, and any persons skilled in the art would find it difficult to produce the claimed composite reverse osmosis membrane, based on Document 1.

Therefore, the claimed invention should have novelty and inventive step over the Document 1.

The technical characteristics of the claimed composite reverse osmosis membrane include the feature that the contact angle does not exceed  $45^\circ$ . Composite reverse osmosis membranes of the claimed invention are not limited to membranes produced in the claimed method, as long as they meet the requirement.

② JP 59-132905, A (Document 2)

Document 2 relates to an encapsulated semipermeable membrane.

As the Examiner has pointed out, this reference discloses an encapsulated semipermeable membrane comprising polyethylene amine and either a polymer or a monomer having a carboxylic acid chloride group.

However, Document 2 has no description or suggestion about a composite reverse osmosis membrane comprising a polyamide skin layer whose contact angle with water is no more than 45°. Or Document 2 does not describe or suggest obtaining high rejection and permeate speed even at a low operation pressure, unlike the claimed invention.

Therefore, The claimed invention has both novelty and inventive step over Document 2.

③ A combination of Documents 1 and 2

As mentioned above, the references do not describe or suggest the claimed constituent feature, which is that the contact angle between the polyamide skin layer surface and water does not exceed 45°. Also the references do not describe or suggest the advantageous effect of the claimed invention. Specifically that a high rejection and permeate flow rate can be obtained even if the operation pressure is low.

Therefore, there is no evidence that a person skilled in the art would combine these references to obtain the claimed invention. It is impossible to obtain the claimed invention even by using the combination, since the references do not describe or suggest the constituent feature or effects of the claimed invention.

(5) As mentioned above, the claimed invention is not same to the invention disclosed in the references cited in the International Research Report, and it cannot be obtained easily by any persons skilled in the art in view of the references. Therefore, it is believed that the claimed invention has novelty and inventive step.

6. List of appended documents

(1) Written Amendment: 1 copy